

AMRAD NEWSLETTER

Amateur Radio Research and Development Corporation **OCTOBER '83**

AMRAD Meetings for 1984

The following is a list of the meeting dates for AMRAD in 1984:

January 16	
February 6	Hal Feinstein on Spread Spectrum
March 5	
April 2	
May 7	Update on Trenton and Dayton
June 4	
July 2	
August 6	
September 10	
October 1	
November 5	
December 3	Annual Business Meeting

AMRAD is looking for speakers for the above meetings that don't already have a topic listed.

Upcoming Events

Vienna Winterfest

The Vienna Winterfest(TM) is being held on Sunday, February 26, 1984 at the Vienna Community Center, 120 Cherry St., Vienna VA. Doors open at 8 AM for the general public. Admission is \$4.00.

AMRAD will have two tables in the lower room, right next to Metrovision. Small items for sale can be left at the AMRAD tables by members.

Trenton Computer Festival

The Trenton Computer Festival (TCF84) is being held on April 14 and 15, 1984, at the Trenton State College, in Trenton NJ. This is one of the larger computerfests on the east coast, and anyone into computers should be interested in this one.

Third ARRL Packet Conference

As part of the above-mentioned Trenton Computer Festival, the Third ARRL Packet Conference will be held on April 15, 1984, starting at 10:30 AM. No separate fee above the cost of the Computer Festival is required. Anyone interested in presenting a paper at the conference should contact Paul Rinaldo, W4RI at the ARRL. Proceedings will be made available at the conference.

Dayton Hamvention

Dayton will be held April 27, 28, and 29, 1984 at the Hara Arena. Opening times are as follows:

Friday, April 27	Noon
Saturday, April 28	8 AM
Sunday, April 29	8 AM

Advanced Registration	\$ 7.50
Registration at door	\$10.00
Advanced Banquet	\$14.00
Banquet at door	\$16.00 (if available)
Flea Market (3 days)	\$15.00 per space

(advance registration only on Flea Market).

Advanced registration closes April 13.

Contact the Dayton Hamvention
PO Box 44
Dayton, Ohio 45401

1984 Radio Amateur's Handbook

The 1984 version of the ARRL's handbook is out, and it's looking pretty good. Mixed in with the transmitters, receivers, and SWR bridges is an expanded section on specialized communications. This includes fast and slow scan ATV, RTTY, AMTOR, packet radio, and even spread spectrum. Our founding father, Paul, W4RI has already made inroads into the world of tube radios and TVI. A brief history of these techniques is included for those interested.

Paul is looking for more input for the 1985 handbook, primarily construction projects. Anyone having such a project should write to him at:

Paul Rinaldo, W4RI
Manager, Technical Dept.
225 Main St.
Newington, CT 06111

Sony 2002 Receiver

My newest toy is a Sony 2002 receiver. This receiver covers 153 KHz to 30 MHz in AM/SSB mode, and 78 to 108 MHz in FM mode. It is keyboard direct-entry "tuned", and has 10 memories. This is some hot receiver. Using the internal antenna, it almost compares to my ICOM 720 on the outside antenna. Paul has now obtained one of these radios, and is doing some reverse-engineering on it at the ARRL. I plan to hook the 2002 up to the GLB packet board, and my Model 100 for portable HF packet reception. The one problem I have noticed so far is that the VFO seems to pull in the presence of strong signals.

Call for Articles

In case you haven't been aware of it, the AMRAD Newsletter has been rather sporadic lately (at best). One of the reasons is that we haven't received many articles from people other than the usual few people. The more we have to generate, the less time we have to work on other projects. If anyone has done something they think might be useful to our readers, please send it in. I would prefer to receive it over the phone (WordStar (TM) compatible best, but normal ASCII ok), on standard IBM compatible 8 inch CP/M format disk, but I can take typed articles too. Please send any articles to AMRAD's address on the back of this newsletter, or arrange to modem it to me by calling me at home.

AMRAD CBBS(TM) System

The AMRAD CBBS(TM) has gone under major revisions in the last few months. In addition to being changed from 5 1/4 inch North Star format disks to 8 inch single-density CP/M format, the local console has been changed, different memory is in the frame, and a lot of smaller changes have been made. The software is also a newer version of CBBS from Ward and Randy. The system is going through final debugging now, and should be on-line before long.

This is in memory of Victor C. Clark, W4KFC, who passed away on November 25, 1983. Vic was president of the American Radio Relay League. However, many of us knew him in his earlier role as Director of the Roanoke Division of the ARRL. Those living in the Washington, DC area may have come across his signal on the air, possibly in a contest, working stations that others could barely hear.

Vic was well known as a League official and an active radio amateur. He was not one to sound his own horn, and you may not be aware of his technical interests and accomplishments. While he was not an AMRAD member, he was a friend of AMRAD and had a solid appreciation for Amateur-Radio technology. He was a supporter of the Amateur-Radio space program (AMSAT Life Member no. 25) and worked during his last days to clear the way for

Owen Garriott, W5LFL, operate from STS-9. You may not know that Vic was a Senior Member of the IEEE and the principal architect of the instrument-landing system (ILS) installed in U.S. airports since WWII. I understand that this system has been so reliable that not a single air accident has been attributed to faults in the ILS design.

The ARRL will sorely miss him. His twenty months as president were far too short. Certainly he would have contributed his special abilities to Amateur Radio for another fifteen or twenty years given the chance.

A memorial fund has been established in Vic's memory under the ARRL Foundation. The details will be forthcoming in QST.

We've all lost a good friend. -- W4RI



RIGGING FOR PORTABLE PACKETS

Bob Bruninga
6103 Hillmeade Rd
Bowie, Md. 20715

In preparing for portable packet operation, I was happy to find the current drain of the VADCG board was less than 1 amp, but dissatisfied by the requirement for the -5 and -12 volt supplies. With a little experimentation, what resulted was a DC converter using a surplus 88 millihenry torroid or small pot-core to derive both of the negative voltages from +12 volts.

The pot-core was stripped of all turns and rewound with the original wire (no. 26) for 3 turns per volt. That equates to a center tapped primary winding of 72 turns. The secondary was wound for its nominal voltage plus diode voltage drops, plus 5 percent for good measure. This results in one winding of 80 turns tapped at 22, 40 and 58 turns from one end. The feedback coil was wound as 24 turns centertapped. The bias resistors were chosen to be the largest values that would still initiate and sustain oscillations. Junk box components were used throughout, and values were not critical. The transistors should have about one square inch of heatsink because they will dissipate about 1/3 watt each. In my circuit, the total current was 100 ma at 12 volts while supplying 85 ma at -5 volts and 20 ma at -12 volts for an efficiency of 35%.

The output voltage is mostly dependent on the input voltage and the turns ratio. The -12 volts is not critical so the output voltage was adjusted to provide -5 volts under load by adding a very small series dropping resistance at the 12 volt input of the converter. Regulation of the output is proportional to the 12 volt input regulation. I adjusted the -5 volt output so it was -4.7 volts with a 12 volt input which results in -5.4 volts with

13.8 volts input. Throughout the experimental phase, my VADCG board survived voltages from 0 to -9 on the -5 volt line, 0 to -15 on the -12 volt line, and two 1 second shots of 12 volts on the +5 volt line... all without failure.

A small problem with starting oscillations was solved by unequally biasing the two transistors and adding a capacitor across the input. Without these, sometimes the circuit would start up on a several MHz parasitic. I also added a .001mf capacitor not shown on the schematic across the primary to suppress switching spikes. With the small heatsinks clamped around the transistors, the converter operates with only a slight temperature rise.

My original design was to power the converter from the series current being dropped from 12 volts down to 5 volts. By designing the converter to operate on 7 volts, it could use current otherwise being wasted. After two short circuit failures of the transistors zapping 12 volts across my 5 volt bus, I abandoned that approach. I changed from garden variety logic level transistors to 2N2222, rewound the torroid and powered it directly from 12 volts. The additional 100 ma from the 12 volt source is insignificant compared to the 700 ma for the 5 volt bus plus 1 amp each for the terminal and tv set needed to complete the station.

If I was designing for portable operation using a battery terminal such as the TRS-80 mod 100 and a walkie-talkie, I would rewind the torroid for 6 volt input and power the system from 5 NiCads. A single diode and .4 ohm resistor would provide the 5 volt bus.

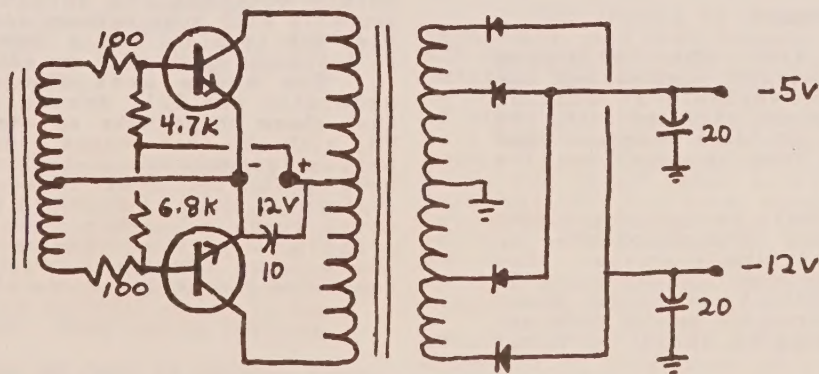


Figure 1. A DC/DC converter for developing negative supplies for the VADCG packet board.

Review of the GLB Electronics PK1 Packet Board

Terry Fox, WB4JFI
1819 Anderson Rd.
Falls Church, VA 22043

While reading a recent issue of Ham Radio, I came upon an ad by GLB Electronics (yes, the famed synthesizer company) for a packet radio controller board. The immediate attention getter was the price. For a wired and tested board with modem included, the base price was \$149.95! Imagine that, GLB had accomplished an awful lot on a board only 4.5 by 8.5 inches! The ad included a picture of the board, which didn't have the typical number of large ICs on it, and I was even more intrigued. The ad stated that it was already available for Vancouver protocol, and that AX.25 would be released "soon". Some of the immediate questions I had were:

What type of CPU did it use?
What type of protocol chip is it using?
How much memory is available?
What type of modem is on it?
Why so few chips on the board?
What language is the code written in?
What is the manual like?
What type of device is it expected to be connected to?
How does it interface to the radio?

Well, it was a Saturday, and GLB wasn't answering their phone, so I had to wait until Monday to get some answers.

Monday finally rolled around, and I called GLB about their board. I soon found out that the board uses a Z-80A CPU, has one 2764 EPROM which holds the machine code to run the board, comes with two 6116 RAM chips (4K of RAM) which is readily expandable to 14K of RAM, has the famous EXAR modem chips, interfaces to the terminal thru an RS-232 port, and uses software UARTs for both the HDLC and terminal ports. That's right, software UARTs for BOTH serial channels. Unfortunately, the source code is not available from GLB, preventing user customization. I was also informed that the PK1 was available only with Vancouver code at that time, but AX.25 would be coming by December of 1983. I ended up ordering one with an additional 4K of RAM (you never have enough memory) and the necessary edge connectors.

The board arrived within a week, along with a 25 page manual explaining how to hook up the board and how to use it. The first page of the manual confirmed one of my suspicions, this board owed a lot of its software approach philosophy to Robert Richardson, W4UCH, of Richcraft Engineering. Mr. Richardson authored a paper on this approach to packet radio for the Second ARRL Amateur Radio Computer Networking Conference, held in March 1983, in San Francisco, and has several packet radio products available to TRS-80 users.

PK1 Hardware

I should mention that the following information comes from "reverse engineering" the board, and is being made available so that us "hackers" can better understand this approach. No board layouts, schematics, or block diagrams come with the PK1, which may lead to problems if a failure occurs.

Figure 1 shows the basic layout of the PK1. Since all of the hard work is accomplished in software, the board is relatively sparse. Plus twelve volts applied to one edge connector pin is regulated down to five volts by a typical three terminal regulator. The extensive use of CMOS and the overall lack of components keeps the power draw below 200 ma.

The Z80A CPU is driven by a 3.579545 MHz clock, generated by a CMOS inverter. No address or data bus buffering is used or necessary, due to the simplicity of the board. It is layed out to accept 28 pin memory chips at all locations, allowing room for future expansion. One 2764 and two 6116 chips come standard, allowing 4K of EPROM and the same amount of RAM. More RAM will allow the user more data buffers, but unless the user is running a model 28, this is not as useful as I had hoped.

The 74HC32 and 74HC42 are used as memory and port decoders. Since the PK1 uses software UARTs, all that is required for I/O is one input and one output port. This includes some handshaking lines for both the terminal and the modem. Table 1 shows the input and output port assignments. In addition to being one of the input port bits, serial data from the terminal also generates the only interrupt used by the board. The input port uses an 80C97, and the output port is two CD4013 dual-D flip-flops. Table 2 shows the connections for the two edge connectors on the PK1.

Bits->	7	6	5	4	3	2	1	0
INPUT	!Radio	!Term	!Term	!Radio	!Radio			
PORT	!Data	!Data	!RTS	!Sqlch	!CD			
OUTPUT	!Term	!Term	!Term	!Radio	!Radio			
PORT	!CTS	!Data	!Data	!Enab	!Data			

Table 1. Input/Output Port Bit Assignments

R	S	+	C	
R	C	5	T	
E	V	V	S	Term.
S	E			/----Data
E	A	O	G	!G
T	U	U	U	!N
9	7	5	3	!D
1	8	6	4	!D
0	!	!	!	!D
G	X	X	+	!D
N	M	M	1	!D
D	T	T	2	!D
			V	!D
P	A			!D
T	U			!D
T	D			!D

Table 2. Edge Connectors Pinout

I should point out that the PK1 claims to be RS-232 compatible on the terminal end. Just like a lot of the cheaper computers (ie. Commodore) RS-232 isn't really RS-232. The PK1 actually provides serial data with one set of handshaking lines at TTL voltage levels, NOT EIA levels. GLB points out that the levels are enough to work properly with most devices (and it did work with a Mini-Bee terminal and a Model 100 computer), but it failed to work with my old Xitex video board.

The modem uses the standard EXAR 2206 modulator and 2211 demodulator ICs. GLB feels that these chips make an adequate modem for VHF-FM, although they suggest you tap into your radio before de-emphasis in the receiver. Some tests have indicated that these PLL modems do not perform as well as standard filter type modems on noisy signals however. In any event, I had no problems with the modem and interfacing the PK1 board to my IC-2AT as shown in Figure 2. This completes the hardware description of the PK1.

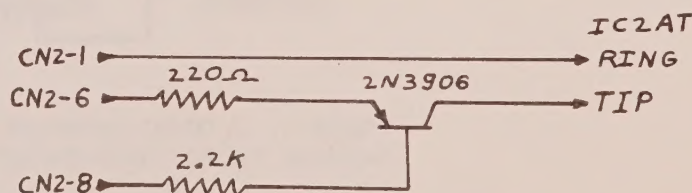


Figure 2. IC-2AT Transmit Interface

PK1 Software Support

The advertisements for the PK1 state that it is capable of over fifty commands. These commands fall into four basic categories:

1. Setup (S) Commands.
2. Manual (M) Operations.
3. Automatic (A) Operations.
4. Miscellaneous Commands.

In addition, I found another group of commands that aren't documented in the manual, they are debug (D) commands that allow display and modification of memory locations in the PK1.

Setup Commands

The Setup commands allow the PK1 user to read or modify the status of various parameters of the board. Some of these commands set software "switches", while others allow modification of operation parameters. These commands are:

S(return) Display board status.
SA(n) Set Vancouver Address to "n".
SB(D/E) Disable/Enable carrier backoff.
SCWB4JFI Set the Callsign of this board.
SDK8MMO Set destination Callsign.
SE(D/E) Disable/Enable terminal echo.
SF(n) Set preframe delay to "n" bytes.
SG(D/E) Disable/Enable "garbage" mode.
SH(n) Set max number frames per transmission.
SI Re-initialize board to power-up values.
SL(n) Set max number of bytes per frame.
SM(n) Allocate "n" blocks for xmit buffers.
SN(n) Set number of retries to "n".
SP(n) Set RX-to-TX delay to "2n" msec.
SR(B,D,H,O) Set radix binary, decimal, hex, octal.
SS(n) Set cw identification speed to "n" WPM.
ST(n) Set retry delay in tenths of seconds.
SX(n) Set exit character for "I" command.
SZ(D/E) Disable/Enable leading zeros on numbers.

Manual Commands

The manual commands are used to force the PK1 to send certain frames, or prepare it for sending certain frames. The manual commands are:

MA(n) Set the manual address field to "n".
MC(n) Set the manual control field to "n".
MD Manually send a disconnect frame.
MI Force a cw identification transmission.
MT Manually send a frame with above set address and control fields, and data from next transmit buffer.

Automatic Commands

The next group of commands are used to tell the PK1 to perform some automatic function. Most of these commands have to do with "connected" operation. They are:

AA Send an "RR" (ack) frame (after AW below).
AC Request a connection with station set by SD.
AD Request a disconnection from present station.
AH Halt transmitting until AR command.
AR Resume transmitting after AH command.
AS Standby (no TX or RX) until AU command.
AT Transmit frame until acknowledged.
AU Undo standby mode above.
AW Send "RNR" (wait) frame to other station.
AX Abort current transmission.

Miscellaneous Commands

The following group of commands make up the rest of the documented commands for the PK1. They allow data to be entered, displayed, and deleted between the buffers and the terminal. There is also a group of commands that are used in a special mode of operation of the PK1, called "Block Mode". Block Mode allows a computer to pre-process data to and from the PK1, which is how the PK1 is designed to work. They are as follows:

I(ab)(data) Enter "ab" bytes of data to buffer (used in block mode).
I(data) Enter bytes to buffer until CTL-D (normal mode).
K Kill contents of transmit buffer.
T Type contents of transmit buffer.
OA(n) Receive frames only with address of "n".
OB(D/E) Disable/Enable block mode.
OD(D/E) Disable/Enable display non-info frames.
OH(D/E) Disable/Enable header display.
OL(D/E) Disable/Enable auto line feed.
OM Display 1 frame from receive buffer.
ON(n) Insert "n" nulls after CR.
OO(D/E) Disable/Enable connect-only mode.
OQ(D/E) Disable/Enable Queue-up mode.
OU(D/E) Disable/Enable status updates on term.
OW(n) Set line length to "n" characters.

Debug Commands

As mentioned earlier, I found that there are some undocumented commands in the PK1. These commands allow some rudimentary debugging, but since they are NOT documented, they may not be available on all PK1's. They are:

DD(adr) Dump one line of hex at memory "adr".
DF Unknown at this point, does something.
DS(adr,data) Substitute new data at address "adr".
DT(adr) Display 5 lines of memory starting at address "adr" in hex and ASCII.
DZ Seems to jump to terminal speed set routine to allow speed change.

PK1 Operation

The above commands imply that the PK1 is very flexible. The board works well as promised (using Vancouver protocol only at this point) with one important stipulation. As GLB points out, this board is designed to work in conjunction with a computer operating as a smart terminal. Since the PK1 uses software UARTs for BOTH the terminal AND the link connections, one of these two will be ignored when the other is active. GLB has decided to make the terminal side the higher priority device, and as such, whenever there is any data in the terminal buffer (implying active terminal status), the packet side of the PK1 is ignored. I found this out the hard way. After hooking up power, wiring the PK1 to my Mini-Bee terminal, and bringing up the board, I had Cliff, W4CQI (the only one in our group still with Vancouver capability) connect to me. Every time I typed in even one character at the terminal, the PK1 would ignore totally the link side. Inevitably, this would happen just as Cliff sent me a frame. Since the PK1 link had gone to sleep, I never received or ack'd his frame, causing him to retry until he gave up and declared the link broken. About that time, I would be finished typing in data, and would hit the "send the frame" character, causing my frame to be sent to Cliff. Cliff, having just declared the link bad and disconnected, was then receiving and ignoring my frames until I gave up trying and declared the link bad. Needless to say, this became very frustrating very quickly at both ends.

To add to the frustration, the PK1 operates differently than the other boards. To send a frame, the operator must first type "I" to indicate to the PK1 that the user wants to "insert" data into a transmit buffer. When the user is done sending data into the transmit buffer, an "escape" character is sent to the PK1. Next, the user must type "AT" in connect mode, or "MT" in unconnected mode to actually transmit the data. This whole sequence must be done EVERY TIME A FRAME IS SENT! In addition, in unconnected mode, a "K" command must be sent before the "I" command to kill the old contents of the buffer, otherwise the new data is appended to the old data already in the buffer. Remember also, anytime there is ANY data in a transmit buffer (even old data before the "K" command is used), the packet channel is being ignored.

GLB admits to these problems with dumb terminals, and even suggests that this board is NOT designed to operate with dumb terminals. They point to the price of the board (least expensive on the market) and state that the real advantage of using this board comes when it is used almost as a "smart modem" to a computer. The PK1 has a mode of operation called "block mode". In this mode, the board takes a burst of data from the terminal (with a byte count at the head), and transmits the data once the byte count has been reached. When the PK1 receives a frame, it notifies the computer by sending certain characters indicating which part of the frame is coming next (data after a "!", address field after a ":", control field after a "-", and PK1 status after a "#"). It should be noted that the same commands as those used by a dumb terminal must also be used by the computer to make the PK1 do something, but this should be trivial once the computer is programmed to operate with the PK1 in block mode.

It looks like GLB did a good job of coming up with a simple yet effective system of interfacing their board to a computer. The above description does not describe in minute detail how this interface works, but rather gives the reader the general idea of how this block mode functions. For more details (such as that needed to actually write code for a computer), it is recommended that at least the manual for a PK1 be purchased.

CONTINUED NEXT PAGE

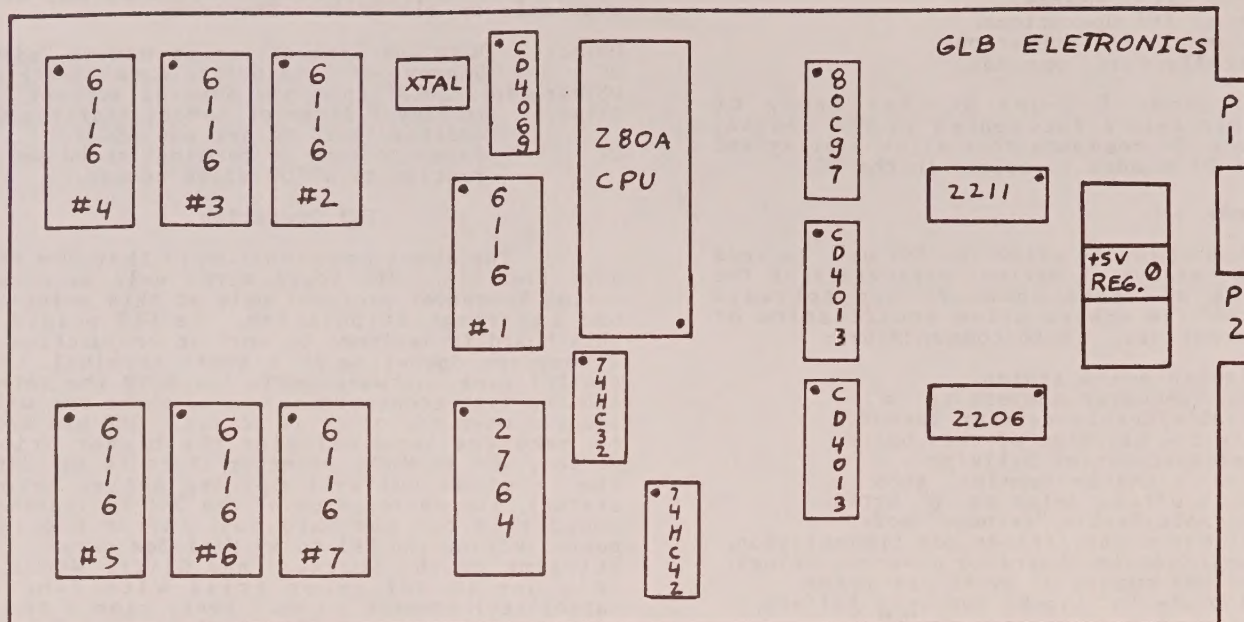


FIGURE 1. GLB PK-1 BOARD LAYOUT

Another "frill" GLB put into the PK1 is that it can be used with a Baudot type terminal in addition to ASCII devices. Whenever the board is powered up or reset, it reads the first character sent it from the terminal and sets both the speed and the code used for the terminal once it receives a valid carriage return character. Since the above mentioned dumb terminal problems will occur regardless of terminal type, using a Baudot terminal is of questionable value. The main advantage of this Baudot operation, and that of adding more memory is that someone could put a PK1 with an old model 28 and rig in the corner of the shack to monitor packet activity on a channel.

I should mention again that at this time the PK1 is available only with the Vancouver protocol.

GLB has stated that AX.25 will be available soon, and I will give an update when the new EPROM shows up. GLB has indicated that they will continue to support the Vancouver protocol when the AX.25 code shows up, and that the AX.25 will be an addition.

In conclusion, the GLB PK1 is a very cost-effective board when used with a computer to get into packet radio. I would recommend that the edge connectors be purchased with the board (an additional \$10.00). Write to:

GLB Electronics
1952 Clinton St.
Buffalo, NY 14206
716-824-7296

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PROTOCOL

David W. Borden, K8MMO
Rte 2, Box 233R
Sterling, VA 22170
703-450-5284

Packet Repeater

The AMRAD Simplex Packet Repeater, 147.585, is up and running very well. It's new location, on the Channel 9 (WDVM) tower at 200 feet is working very well. Just about all packeteers can hit it and work through it easily. Some have to run a little higher power or use a better beam, but it is a very good machine. It is currently running 14 watts, which seems to be plenty of power. It is on the South leg of the tower, so folks to the North have to work a little harder to hit it as it favors all but North. It has been heard in Southern Pennsylvania.

Metro Area Packet Activity

The following packeteers are active on packet, unless listed "sleeping" which means they can packet, but have not been heard lately:

AJ9X	0	Mike, the person
AJ9X	1	Mike, the RBBS Mailbox on 147.81/.21
K3HOI	0	John
K8MMO	2	Dave, the person
K8MMO	1	Dave, the computer on 147.585
KE3Z	0	Jon, the person
KE3Z	1	Jon the S-100 experimental packet box
W4CQI	0	Cliff
W4MIB	0	Bill (sleeping)
WA3MEZO		Rod
WB4APRO		Bob
WB4JFIO		Terry
WB4NFB0		Bill (sleeping - actually Howard broke his board while testing)
WD5DBC0		Howard

Packet Operation

It is always good to review packet operation for newcomers and old timers who forgot how. In AX.25 the callsign is a seven position field. The first six positions are the ham call, right padded with two spaces for short calls like KE3Z or one space for medium calls like K8MMO. The last position of the field is the SSID. Some of us have more than one packet device per station. K8MMO 2 is my terminal and K8MMO 1 is my host computer. I could have lots of devices and some people do.

There must be a way use your terminal to send messages through your packet board, and use the same terminal to command the packet board to act in a certain way. When using Vancouver boards, we send a command sequence, Control-P (a 10 hex) when we want to send a command to the packet board. To begin packet work, reset your board and you will see the sign-on message which will announce what level software you have. Usually, most people send Control-P L which tells the board to send a Line Feed (the usual character to terminate a packet and send it) after seeing a carriage return. Then we usually want to install the repeater address so we can work through the AMRAD packet repeater. We do this by sending WB4JFI5 Control-P R which installs the repeater address in our repeater field. Now, sending a carriage return at this point should get the repeater to repeat it. If you now want to talk to Cliff, for example, send W4CQI 0 Control-P C and the board will try five times to connect with Cliff. If connection is successful, you will see:

*CNCT**W4CQI 0WB4JFIu?

This indicates you are hooked up to Cliff and can type to him. If while typing you tire of seeing what you type mixed up with what he types, send Control-P NE, and nothing you type will be seen (it is better have one station use lower case and let the other station use upper). If you change your mind and want to see what you type, Control-P E will restore the echo.

When you say 73 to Cliff, disconnect from him by typing Control-P D and you are ready to connect to someone else. If you want to go direct and not through the repeater (change freqs please), send Control-P NR to disinstall the repeater address field.

Vancouver Fix

The master clock is not always stable according to the father of the Vancouver board. He suggests installing a 20pf capacitor from each side of the crystal to ground. Doug says this will help instability and is probably the answer to some boards sleeping on the job on occasion.

Boards Available

Terry thought it was time again to review the various packet boards available. The attached comments are mine and not the views of AMRAD, TAPR, ARRL or VADCG.

Vancouver Board

This is the original packet radio board. It uses an 8085 microprocessor, 8273 packet chip and 2708 EPROM. Software is available from AMRAD, both Terminal operations, Host computer operations and Repeater operation, using the AX.25 protocol. The following prices are current:

\$169 Assembled and tested TNC (no power supply or cabinet)

\$136 Complete TNC kit for serial RS232 connection including PC board, 8k memory, all components and sockets (no power supply or cabinet).

\$19.95 PC Bare Board only

\$15 202 1200 Baud XR type modem PC Bare Board

\$70 202 1200 Baud XR type modem assembled and tested

\$44 8273 chip

Send money to:

VADCG
9531 Odlin Road
Richmond, B.C. V6X 1E1

Delivery is quick, Doug does excellent mailing and has the stuff on hand. I do not recommend the modem for satellite work, but on FM voice channels it is adequate. The software is written in 8085 assembly language and is changable by anyone with a CP/M system and a 2708 prom burner.

2. The TAPR Board

The TAPR board was the second packet radio board constructed and most agree it is the best. It is expensive and generally unavailable, but the club is making an attempt to ship them eventually. Currently it is available only in kit form. It uses an 6809 microprocessor, 1933 packet chip and 32K of EPROM. The power supply is included, but no cabinet (although one is available). It has more commands than you can memorize, but help is available. The commands cover just about anything you ever want to do. It covers both AX.25 and VADCG protocols and has a built in XR type 202 1200 Baud modem. You should contact TAPR and enquire as to availability. They are having trouble getting parts so shipping is backordered for a long time. The price is \$240 plus \$7 shipping and handling. Contact them:

Tucson Amateur Packet Radio Corp.
P.O. Box 22888
Tucson, AZ 855734

The manual is available separately for \$15. The design went through a 200 ham Beta testing and the bugs were found and removed. I have used the board and it is great, only a radio (I used my ICOM 2-AT) is needed to packet. If you can find one of the Beta test folk to sell you a board, that would be ideal. It has only one small drawback that we found. In HF or satellite work, the XR modem is not usable. A separate commercial modem is required and available at most hamfests in the \$20 range. Connecting the separate modem to the TAPR board is difficult. The new board may have resolved this problem. The old boards have a nice kludge are to work in for experimenting. The software is written in 6809 assembly language and PASCAL and is not changable my normal people although the source is available.

3. The Bill Ashby Board

A New Jersey Packeteer of note, Bill Ashby, makes a Vancouver look alike board. It is smaller, but uses the same technology (8085-8273-8250). It achieves the small size by using 2716 ROMs and denser RAMs, thus less real estate on the board. The price is \$80 with all sockets soldered, \$80 for all the ICs except the 2716 ROMs and \$240 assembled and tested. Bill's address is:

Bill Ashby, K2TKN
Box 332
Pluckemin, N.J. 07978

4. GLB Electronics PK-1 Board

A different approach has been taken by GLB Electronics. For a mere \$149.95, they provide a packet board, modem and handle ASCII or Baudot terminals. The board uses a Z80 microprocessor, 8K of ROM and 4K of RAM (expandable). The VADCG protocol is available now and AX.25 by the end of the year (for a slight additional charge and ROM exchange). Terry, WB4JFI bought one of these boards, which uses no protocol chip like the 8273 or 1933 and is a totally software approach, for testing. We failed since no one in the Metro area is running VADCG protocol anymore due to it's limited addressing scheme and the fact the amateur standard is AX.25. Terry will report on this board just as soon as the AX.25 chips arrive. The source code is unavailable and thus the software is unchangable by normal persons. This could be the most cost effective approach to packet radio yet.

Obviously, you are paying for the software development on this board and it seems an excellent approach to low cost packeteering.

5. AMRAD PAD

AMRAD is working on a PAD board (Packet Assembler/Disassembler) which uses a Z80 microprocessor, 8530 two port packet chip and 64K of RAM/ROM. A prototype has been built in wirewrap. The schematic has been drawn and is being shipped to board makers for quotes. Code is being written in assembly language and "C". It may someday come available, but no promises. The 8530 is a super chip and is only \$33.



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The Amateur Radio Research and Development Corporation (AMRAD) is a worldwide club of over 500 amateur radio and computer experimenters. It is incorporated in Virginia and is recognized by the U.S. Internal Revenue Service as a tax-exempt scientific and educational organization.

The purposes of AMRAD are to: develop skills and knowledge in radio and electronic technology; advocate design of experimental equipment and techniques; promote basic and applied research; organize technical forums and symposiums; collect and disseminate technical information; and, provide experimental repeaters.

Meetings are on the 1st Monday of each month at 7:30 P.M. at the Patrick Henry Branch Library, 101 Maple Ave E, Vienna, VA. If the first month is a holiday, an alternate date will be announced in the newsletter. Except for the annual meeting in December, meetings are normally reserved for technical talks - not business.

WD4IWG/R is an open repeater for fm voice and digital communications, especially for experimental modes. It is located at Tyson's Corner, McLean, VA. It features semi-private autopatch available to licensed members. Frequencies are: 147.81 MHz in, 147.21 MHz out. The repeater director is Jeff Brennan, WB4WLW.

WB4JFI/R is a 1200-baud half-duplex packet repeater in Falls Church, VA and may be accessed via WD4IWG/R frequencies.

WB5MMB/R is a 1200-baud simplex packet repeater on 147.585 MHz from Vienna, VA, soon to become K3NA/R from Frederick, MD.

The AMRAD CBBS, 703-734-1387, is operated by Terry Fox, WB4JFI. The system accepts 110, 300, 450 and 600-baud ASCII, Bell 103.

Handicapped Education Exchange, 301-593-7033, is operated by Dick Barth, W3HWN. HEX accepts 110/300-baud ASCII and Baudot deaf TTY/TDD calls.

AMRAD is affiliated with the American Radio Relay League (ARRL), Foundation for Amateur Radio (FAR), Northern Virginia Radio Council (NOVARC) and the Mid Atlantic Repeater Council (T-MARC).

The AMRAD Newsletter is mailed monthly to members and other clubs on an exchange basis. Technical articles, product announcements, news items, and other copy relating to amateur radio and computing are welcome. Honorariums at a rate of \$0.10 per 50-character printed line (\$20 maximum per author per issue) are paid for original material accepted. Classified ads are free to members. Commercial ad inquiries are invited. The editor reserves the right to reject or edit any portions of the copy. Items should be mailed by the 8th of the preceeding month to Editor, AMRAD Newsletter, P.O. Drawer 6148, McLean, VA 22106. Full permission for reprinting or quoting items is granted provided that credit is given to both the author and the newsletter. Mailing to U.S. and possessions is by 3rd Class bulk mail. Canadian and Mexican addresses add US\$2 for postage. Overseas readers add US\$8 for air mail or US\$2.30 for surface.

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